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September 21, 2001

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Ms. Magalie Roman-Salas Secretary **Federal Communications Commission** 445 12th Street, S.W. Washington, DC 20554

> Ex Parte Notification - ET Docket No. 98-153 / Ultra Wideband Re: **Proceeding**

Dear Ms. Salas:

This is to note that on September 20, 2001, Mimi W. Dawson of this firm and I on behalf of Time Domain Corporation along with Ralph Petroff, President of Time Domain, Jeffrey Ross, Time Domain's Vice-President for Development, and Phillip Inglis met with Commissioner Michael Copps and his Legal Advisor Paul Margie to discuss the ultra-wideband proceeding. We explained Time Domain's view that the NPRM's proposed limits were more than adequate for the protection of licensed radio services and urged the Commission to move forward with a decision in this proceeding. In connection with the matter of possible defense applications of UWB technology, Mr. Petroff showed the enclosed slides from a recent conference. In accordance with the Commission's Rules, an original and one copy of this letter are being filed.

Respectfully,

David E. Hilliard

Counsel for Time Domain Corporation

David E. Phillians

cc:

The Honorable Michael Copps

(w/encl.)

Paul Margie, Esq. (w/ encl.)

Enclosure

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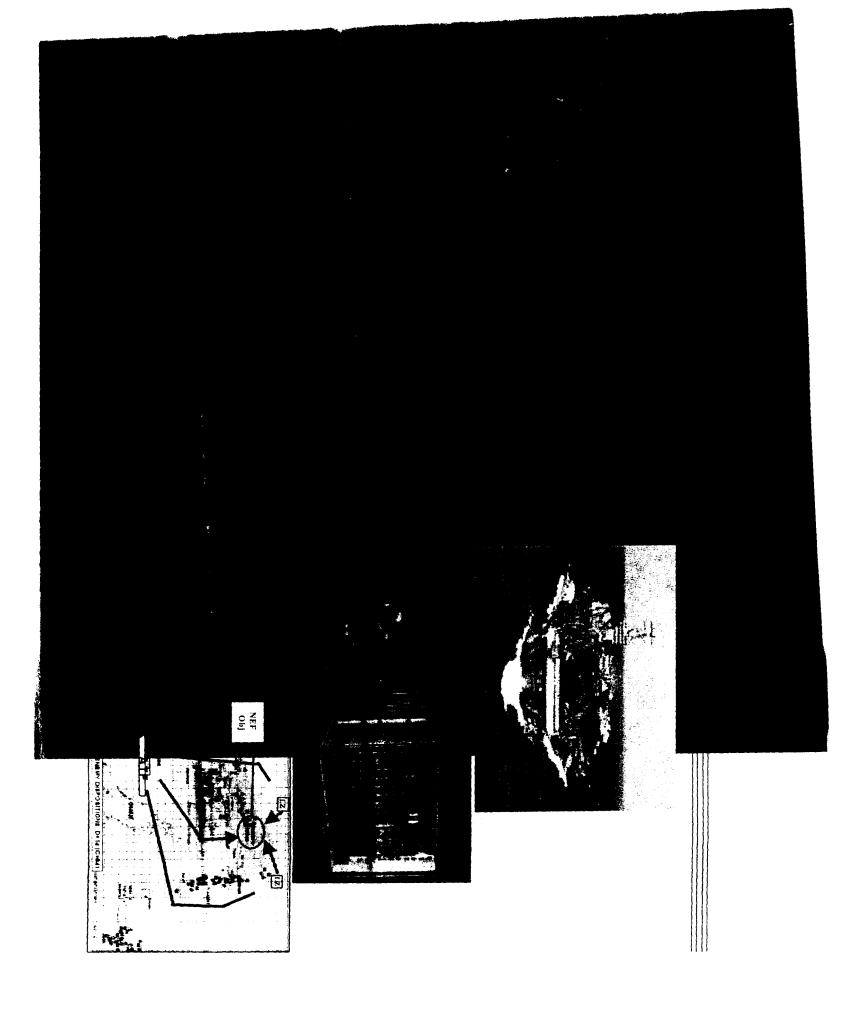
Ultra Wide Band Applications and Requirements

DARPA NETEX Industry Day
McLean, VA

10 Sept 2001

Steven J. Gunderson NFESC Port Hueneme

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UWB Applications: Logistics



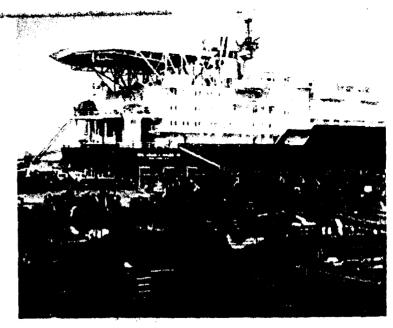
Desert Storm

First MRC with ISO Containers

- 40,000 Containers, Opened 25,000
 - » Paper Manifests Were Inaccurate and Easily Lost
- ISO Containers Hid the Stuff
 - » Previous MRCs Used Break Bulk
- Misplaced & Lost Stuff = \$3 Billion
 GAO Report B-246015, Dec 1991

The BIG Questions

- What Do I Have?
- Where Is My Stuff?
- What Is In the Box?
- What Is Its Condition/History?



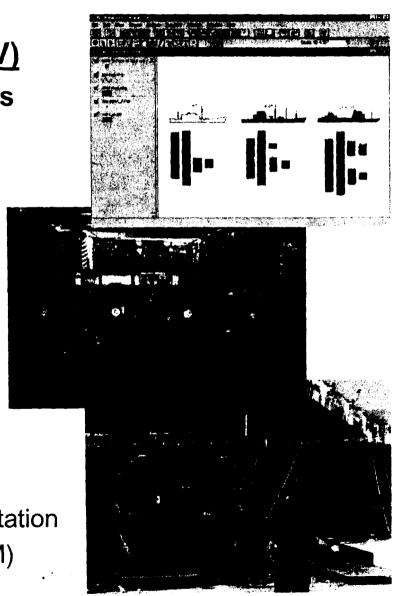


UWB Applications: Logistics



Naval Total Asset Visibility (NTAV)

- Tackle the Unsolved Hard Problems
 - Precision Asset Location (PAL)
 - » Where's my Stuff?
 - » Ship Stow Plans
 - 40% Stow Error, Re-Inventory Required
 - Autonomous Manifesting (AM)
 - » What's in the Box?
 - » The "Holy Grail of Logistics"
 - Infrastructure Reduction (IR)
 - » Cost Reduction (\$K's/Reader)
 - » Ship Pre-Installation and Cabling
- Transportation is a \$1T Industry
 - DoD is Largest Purchaser of Transportation
 - US CINC Transportation (TRANSCOM)

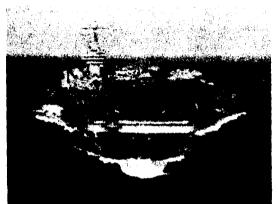


UWB Applications: Weapons

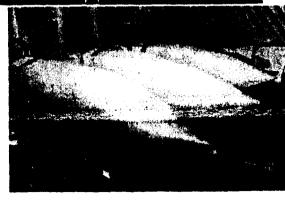


Carrier Weapons Management

- NAVAIR / NAWC Lakehurst
- Problem
 - Aircraft Leave With Partial Loads
 - » Desert Storm: Several Carriers Continuously Launched Aircraft with 2 or Less Weapons
 - Locate Weapon Components for Assembly
 Up to 9 hrs for Assembly: 8 Decks, 32 Mags
 - Locate Weapons in Hanger & Flight Decks
 » Staging Areas, Main Deck, Bomb Farm
- Hot RF Spots Throughout Carrier
 - High Powered Radars: EMI / EMC / HERO
- Proposed Solution
 - UWB Precision Location of Weapon Sleds: 1 ft
- Makes Aircraft Carriers More Lethal







UWB Applications: Geolocation

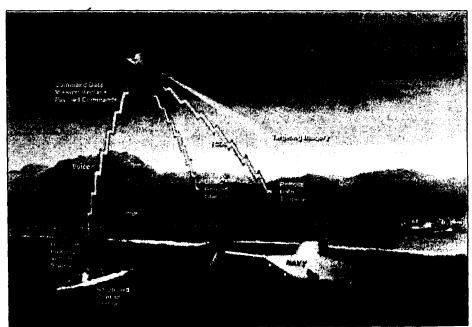


UAV Landing System

- UAV Common Automatic Recovery System (UCARS)
 - Pioneer UAV
 - Microwave: 3 ft Accuracy
 - 6 ft Landing Grid
 - » Pitch / Roll / Stability
 - » Ship Under Way

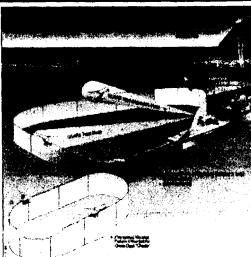
RQ-8 Vertical Takeoff UAV

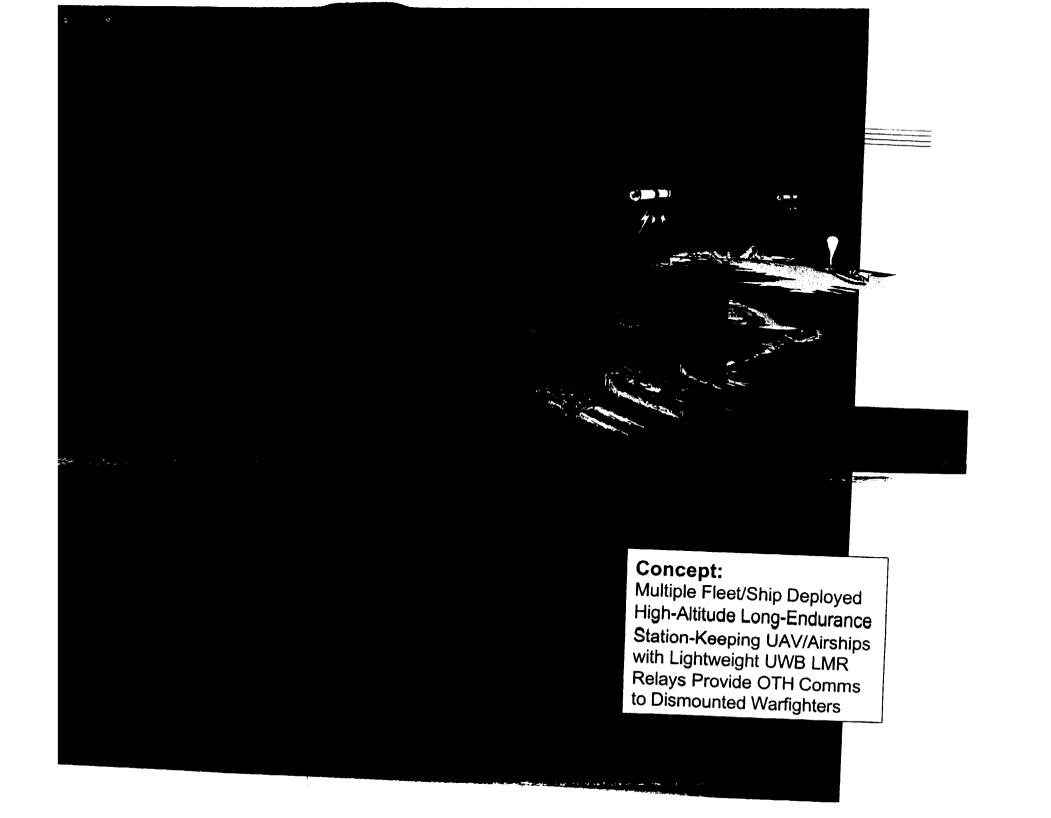
- 3 hrs 150 nmi, 12 hrs Total
- Payload Capacity = 300 lbs
- Comms Payloads
 - » (3) ARC-210 (Aircraft Radio)
 - » TCDL: 14-15 GHz, 10 Mbps
 - » SINCGARS to Ground MEUs









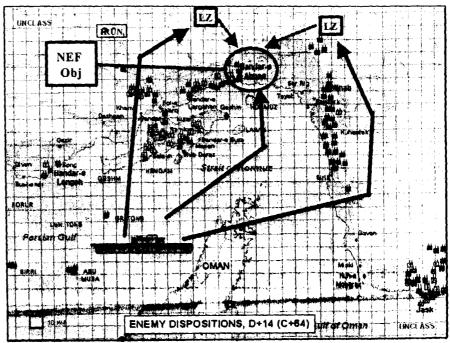


UWB Applications: Comms



Marine Corps OMFTS/STOM

- High Capacity LOS Comms
 - Replace MRC-142
 - » 576 Kb Ship-to-Shore, 25 nm
 - » Losing 1350-1850 MHz Band
- Command Post on the Move
 - Secure Wireless LAN
 - » Connect Servers Within CP
- Convoys on the Move
 - Inter-Vehicle Comms
- Combat ID
 - Geolocation
 - Surface Management
 - » Ship-to-Shore Movement: AAAV & LCAC
- Asset Visibility









DARPA UWB.PPT 9/13/2001 10

UWB Applications: Comms



Urban Warfare

MOUT ACTD / USA / USMC

- Frustrated Requirements: C4I

» R1: Identification of Friendly, Enemy, Noncombatants (IFF)

» R3: Hands-Free Non-Line of Sight (NLOS) Communications

» R7: Thru-Wall Sensing

» R41: Position/Location Inside Buildings

- Military/Com'l Comms Inadequate

» Marine Corps Inter-Squad Radios (ISR)

• ICOM UHF Radios: Non-Secure - 16,000 Units

» Need Secure Radio, 1-5 Km Range

PRC-126 Size, Light Weight (Micro-UAV)

C2 for Unmanned Ground Vehicles & Video

- Transition to Proposed Vanguard ATD '03

- Transition to SBCCOM Objective Force Warrior Program







UWB Applications: Comms



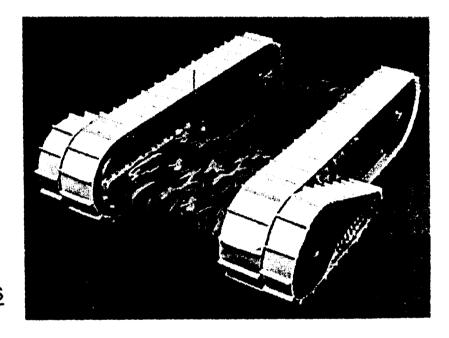
Tactical Mobile Robots (TMR)

Imperatives

- Tele-Operation
 - » C2, Audio and Video
 - » Robots Talk to Each Other
- Geolocation / Navigation
 - » Robots Find Each Other
- Autonomously Reestablish Comms

Requirements

- Bandwidth
 - » C2 & Audio (low latency) 25 Kbps
 - » Video (B&W, fuzzy, min) 100 Kbps
 - » Color Video (160x120) 1-2 Mbps
 - » High Res Video (320x240) 3 Mbps
- Range
 - » 500m min (LAN Block Conv), 1-2 Km



- Weight & Power: 1-2 lb, 2-5 W
- Geolocation: 1 cm
 - » Navigation/Mapping/Marsupial
- Environment
 - » Urban: Streets, Buildings, Sewers, Tunnels
 - "High EMI: DC Motors

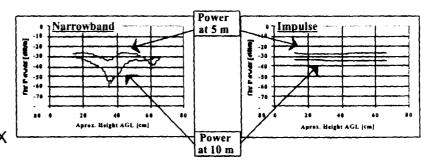
UWB Requirements



<u>Advantages</u>

· Multi-Path

- Minimize Nulls in Urban Environments
- 1/r² -- 1/r⁴ -- 1/r⁶ Losses
 - » 1 2 Orders Better than Narrow Band
 - Extra Transmitter Power Not Needed: 10-100X



Co-Interference

- FHSS: SINCGARS -- >2.5 Radios Co-located
- DSSS: Near-Far Power Management -- Qualcomm 1 dB Match Required
- UWB: 40-50 dB Rejection

Land Mobil Radio (LMR) / Cellular

- Greater Agility: No Critically Tuned Tanks / Combiners / Splitters
- No Dedicated Reservation Channel

Interceptibility

- Inherent LPI/LPD/LPE/AJ

Geolocation

- High Inherent Accuracy: Short Pulse Length ~1 ns = 1 ft
- · Dual Capability: Communications and Geologation Simultaneously

UWB Requirements



Architectures

Voice

- Inter Squad Radio (ISR)
- Land Mobile Radio (LMR)

Data

- Burst Store & Forward
- TCP-IP / Packet
- Ad-Hoc Peer-to-Peer Networks

Video

- High Data Rate 1-3 Mbps

Geolocation

- Intra-Squad
- Urban: Bldgs, Streets, Sewers
- Alternate GPS

Warfighter Requirements

Works Anywhere

- Urban
- Triple Canopy
- Mountain Terrain
- No Terrestrial Infrastructure

Quality

- Fast Enough
- Secure: LPI/LPD/LPE/AJ
- 20 30 dB More Link Margin

Logistics

- Small
- Light
- Cheap

Conclusion



Hunter Warrior AWE

- Marine Corps Warfighting Lab
 - First AWE, 1997 All Data
 - RMA: Asymmetrical Warfare
- DARPA Provided Technology
 - Land Mobil Radio (LMR)
 - Internet Node In the Sky (INITS)
 - Shared Net: Content Centric
 - ADOCS / LeatherNet (M&S)
 - Surrogates, But They Worked
- Burst Store & Forward
 - LMR: Serial, 2.7 Kbps
 - » Short Message: OTH Gold & VMF
 - » 3 Sec on Air, Hard to Locate
 - INITS: TCP-IP, 300 Kbps Total



"In This World Where We're Carrying **Mobile Handsets**, I'm Afraid the Communications of
the World's Most Advanced Military Are Operating
at Levels that are 40 Years Out of Date."

Adm. Owens (ret)

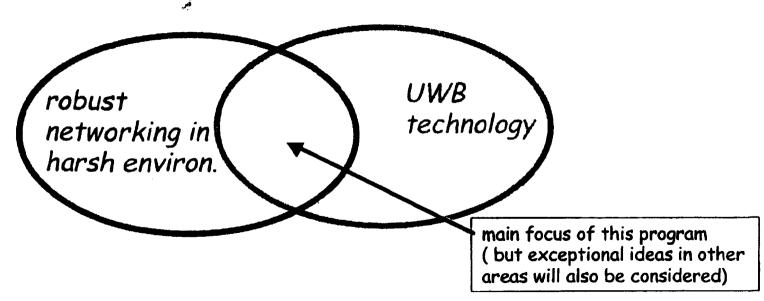
Networking In the Extreme (NETEX) Program

Industry Day Sept 10, 2001

Mari Maeda
Program Manager
Information Technology Office
DARPA

Program Goal

Robust and rapid wireless networking in complex, hostile environments using UWB technology



- robust immunity to fading/outages
- ·complex harsh settings, urban, indoor
- ·hostile low probability of jam/detect
- ·rapid on-the-fly networks, no spectrum assignment

Why Harsh Environments

- Dense urban terrain represents the single most hazardous setting for engagement
- Casualty rate extremely high
- Increasing shift of world population to cities
 85% of world population by 2024
- · GPS often ineffective
- Need to protect our forces, remove personnel from areas of high threat, deploy sensors & robots
- Other harsh settings: on ships, inside cargo containers, close to the ground...

UWB Claims

- No fading from destructive interference (coherent effects are less)
- Potential for single chip, all digital (cost savings)
- Lower power dissipation (few analog components)
- · Built-in LPI/LPD/LPJ
- No need to get spectral allocation (uwb signal is buried in the noise)
- Penetration capability walls, ground (enabled by low frequency component)
- High precision ranging (enabled by high frequency component)

- · Focus on the real advantages of UWB
- Design and implement <u>next-generation</u> UWB hardware and software for ad-hoc networking in extreme environments.
- Develop uwb network-based geolocalization system
- Demonstrate key DOD applications in appropriately harsh, environments

Technical Areas

Precision Geo-Localization

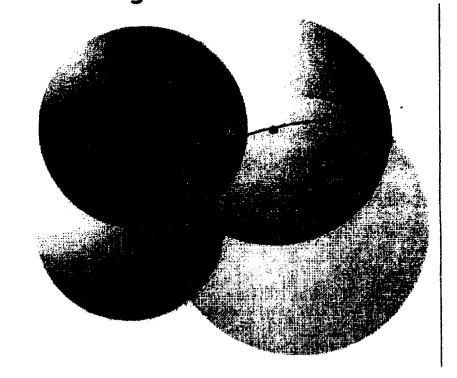
· 3-D multi-lateration

scalable and power-efficient geolocalization

techniques

in-depth tradeoff
 analysis
 (accuracy vs.
 power, number of nodes ..)

mobility support







Ultrawideband (Impulse Radio) Communications Technical Challenges

NETEX Industry Day

10 September 01

Dr. James A. Freebersyser
Program Manager, DARPA/ATO
(703) 696-2296
jfree@darpa.mil



Potential Advantages of UWB



- Ultrawideband Operation (> 1 GHz)
 - Better multipath fading performance (like any wideband signal would)
 - Large processing gain (> 40 dB) improves Anti-Jam (AJ) properties
 - Covert operation (Low Probability of Intercept/Detection (LPI/D))
 - Position location on the order of a few centimeters
- Greatly Reduced Power Consumption
 - Single chip (CMOS) implementation without mixed signal processing
 - Low duty cycle operation
 - Higher energy efficiency due to pulsed battery operation
- More Efficient Use of the Spectrum
 - More users per unit of bandwidth
 - Unregulated (FCC Part 15) operation
 - Reduced near-far interference resulting from low duty cycle operation
 - Full-duplex operation in the same frequency band

The Potential of UWB Impulse Radio Has Not Been Realized



Summary/Conclusion



- Ultrawideband What's Old Is New Again!
 - Wireless could have gone straight to UWB if DSP had been available ©
- A Cornucopia of Commercial and Military Applications
 - Communications, radar, geolocation, automation, measurement, etc.
- UWB Has The Potential for Revolutionary Change
 - Regulatory changes (FCC Part 15?) are needed
- UWB Research Has Only Just Begun
 - Propagation, antennas, circuits, devices, waveforms, signal processing, radio architectures, MAC/network protocols, etc.